Psychophysiological Monitoring of Aerospace Crew State

Completed Technology Project (2017 - 2021)

Project Introduction

As next-generation space exploration missions necessitate increasingly autonomous systems, there is a critical need to better detect and anticipate astronaut interactions with these systems. In line with NASA's Technology Roadmaps, 6.3 Human Health and Performance and 4.4 Human-System Interaction, the success of present and future autonomous technology in exploration spacecraft is ultimately dependent upon safe and efficient interaction with the human operator. Crew state may be affected by a number of variables including impairment, like fatigue or stress, attention failures, like channelized or diverted attention, and decision failures. I hypothesize that I can objectively classify continuous crew state using psychophysiological monitoring of an aerospace crew. Non-obtrusive monitoring techniques including heart rate and eye tracking will allow for minimalistic instrumentation that could be integrated into future spacecrafts and space habitats. Sensor testing and data training will be performed, ideally in a simulated or analogue space environment, to develop task-specific population-based classifiers of crew state. These population-based classifiers could then, in theory, be improved with crew member-specific classifiers. Ultimately, this research aims to develop a non-obtrusive sensor suite and algorithm to detect a suboptimal crew state. Once a crew state is determined, further research into specific countermeasures would be necessary to potentially alter the automation and improve crew state. Combining resources and expertise from Virginia Tech and NASA, through the visiting technologist experiences, would be extremely important for the proposed crew state monitoring and countermeasure research.

Anticipated Benefits

Crew state may be affected by a number of variables including impairment, like fatigue or stress, attention failures, like channelized or diverted attention, and decision failures. This research aims to develop a non-obtrusive sensor suite and algorithm to detect a suboptimal crew state. Once a crew state is determined, further research into specific countermeasures would be necessary to potentially alter the automation and improve crew state.

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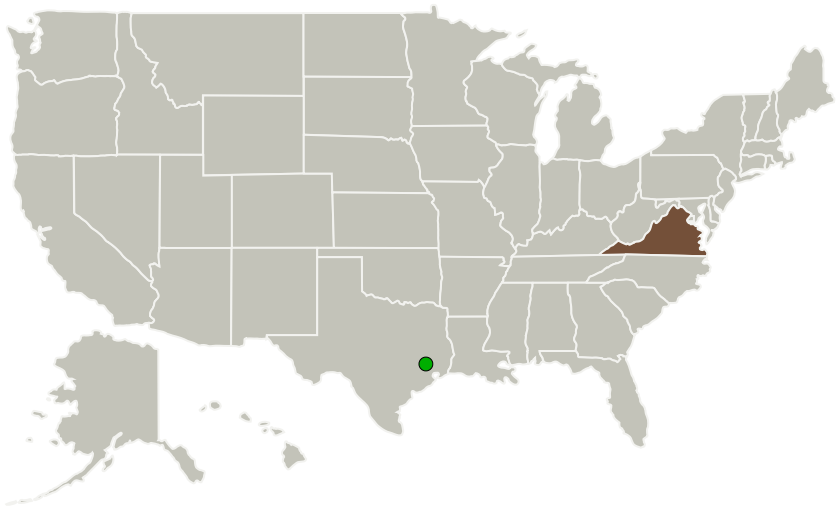
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Virginia Polytechnic Institute and State University(VA Tech)	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPISI)	Blacksburg, Virginia
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations
Virginia

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Virginia Polytechnic Institute and State University (VA Tech)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Hampton Gabler

Co-Investigator:

Grace C Wusk

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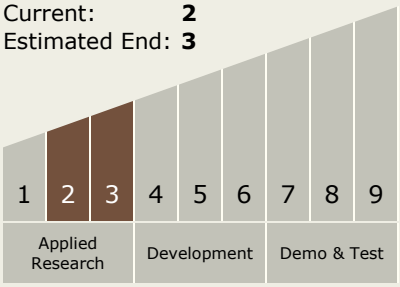
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.3 Behavioral Health and Performance

Target Destinations

The Moon, Mars